5-2018

Attention Deficit Hyperactivity Disorder Medication Abuse at the University of Arkansas

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Attention Deficit Hyperactivity Disorder Medication Abuse at the University of Arkansas

by

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An Honors Thesis in partial fulfillment of the requirements for the degree Bachelor of Science in International Business in Supply Chain Management.

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Fayetteville, Arkansas

May 11, 2018

I. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a condition in children and adults. This disorder is often chronic and has many symptoms including attention difficulty, hyperactivity, and impulsiveness. Treatment for ADHD can help, but this disorder cannot be fully cured. Treatment involves stimulant medication which can aid with the many symptoms of ADHD. Unfortunately, over time these stimulant pills have been abused by both people who are and who are not prescribed. The leading population in which abuse of these drugs is most common is in universities, where students unlawfully take ADHD medications to increase their focus in school. This phenomenon has grown over the years and has caused dependence in the medication. Physical and mental effects also commonly occur when abusing ADHD medication such as increased heartrate and the increased probability of depression.

When a student enters the University of Arkansas, ADHD medications are frequently introduced and classified by students as a common aid for studying. Because the University does not have a specific program to inform and warn students about the consequences of ADHD medication abuse, students who are new to the vigorous demands of college can easily start inadvertently taking the medication.

To further knowledge on ADHD medication abuse at the University of Arkansas and its effects, a student research study was conducted. This study includes the history of ADHD as well as brief inspections of current studies on Attention Deficit Hyperactivity Disorder. After research was read, the researcher proceeded to collect data at the University of Arkansas to gain knowledge of the phenomenon with Arkansas' students in mind. The study was also created in hope to expand policies at the University that will enlighten the commencing students of the University of Arkansas of ADHD medication abuse and the consequences.

I. Attention Deficit Hyperactivity Disorder: The History

The Beginning of Attention Deficit Hyperactivity Disorder (ADHD)

In 1798, A Scottish physician by the name of Sir Alexander Crichton defined attention as "when any object of external sense, or of thought, occupies the mind in such a degree that a person does not receive a clear perception from any other one, he is said to attend to it." This definition was created when scientist conducted research on mental illnesses in the 18th century. Sir Alexander Crichton's discoveries found in chapter 2 of his book, "On Attention and its Diseases", are early depictions of what is known today as ADHD. Crichton concluded in his research that this disorder can be "born with a person" and "when born with a person it becomes evident at a very early age." Crichton's findings were the beginning of something revolutionary and can be furthermore supported by the American Psychiatric Association in that "the symptoms (of ADHD) have to be present before the age of seven" (Lange, Klaus W., et al.). Crichton also wrote that when a child suffers "difficulty sustaining attention in tasks or play activities" that the child's disorder will generally diminish with age. The "growing out" of Attention Deficit Hyperactivity disorder was common until the 1990s until studies around 2006 showed that about 50% of children diagnosed with ADHD carry it with them through adulthood.

Information concerning Attention Deficit Hyperactivity Disorder grew from 1798 to 1900s. Although many see the scientific starting point of ADHD to be in 1902 by Sir George Frederic. Frederic defined a famous symptom of ADHD as children with a defect of moral

control but without a "general impairment of intellect." Frederic was also the first to observe that symptoms of ADHD were more commonly found in adolescent boys than girls, and the symptom of defect of moral control was first shown before the age of 7. This information was found in a study of 20 children with a "defect of moral control as a morbid manifestation, without general impairment of intellect and without physical disease." Frederic believed that symptoms of a lack of moral control could be presented in multiples. The symptoms he gave were:

(1) passionateness; (2) spitefulness – cruelty; (3) jealousy; (4) lawlessness; (5) dishonesty; (6) wanton mischievousness – destructiveness; (7) shamelessness – immodesty; (8) sexual immorality; and (9) viciousness. The keynote of these qualities is self-gratification, the immediate gratification of self without regard either to the good of others or to the larger and more remote good of self. (Still, 1009).

Although many of these symptoms were not directly associated with ADHD, Frederic's research of moral control was a key step in the finding of modern day ADHD.

The next important step to the discovery of ADHD was in the 1930s when German physicians Hans Pollnow and Franz Kramer did research regarding an infancy condition called "hyperkinetic disease." The primary symptom of this disease was motor restlessness. Children with this symptom were not able to sit still for even a few seconds and are constantly acting out on their motor impulses. Today, this symptom is another main characteristic of the hyperactive symptom in ADHD. (Lange, Klaus W., et al.). Kramer and Pollnow also described some of the children effected as have difficulty completing a set task and answering questions directed to them. They were often unable to focus on difficult tasks, which can cause learning deficits and make it harder to assess their intellectual placement and abilities (Lange, Klaus W., et al.). These descriptions comply with the second main symptom of ADHD known as inattention. The DSM-IV-TR depicts children with ADHD as being "easily distracted by extraneous stimuli" and as having "difficulty sustaining attention in tasks or play activities" (Govone). Kramer and Pollnow also found that hyperkinetic disease had a major effect in the subjects' education or schooling. They describe that these children are often disobedient in school and cause disruptions or confusion in class, which is further confirmed by the American Psychiatric Association as being a vital symptom of today's ADHD.

For an ADHD diagnosis in current times, a patient must have symptoms that cause "significant impairment in social, academic, or occupational functioning." (Lange, Klaus W., et al.). Similar to past findings, Kramer and Pollnow found that symptoms of hyperkinetic disease decline in intensity by the age of seven. Today ADHD is said to remain with 50% of people through adulthood, but decreased with age (Davidson, 3). In conclusion, Kramer and Pollnow's hyperkinetic disease of infants defined all three main symptoms of today's ADHD and closely resembles the overall concept.

First Treatment of ADHD

In 1937, a huge discovery in the research of Attention Deficit Hyperactivity Disorder was made. Charles Bradley was performing research in attempt to treat neurologically impaired children. After performing neurological examinations for structural brain abnormalities, children would get headaches due to the loss of spinal fluid. In attempt to reduce headaches, Dr. Bradley tested Benzedrine, which at the time was the most powerful stimulant. Although this stimulant had little effect on headaches, Bradley found that it caused a dramatic improvement in the

Children's behavior and school performance. Subsequently, Bradley began a study with 30 children and had significant alterations in behavior. "The most spectacular change in behavior brought about by the use of Benzedrine was the remarkably improved school performance of approximately half the children" (Bradley, 577–585). Bradley was taken back by the subdued result of a stimulant in some children. It seemed rather paradoxical. Due to his accidental findings, he later identified the children that would best benefit from the stimulant treatment were children seen to have a "short attention span, characterized by short attention span, dyscalculia, mood lability, hyperactivity, impulsiveness, and poor memory" (Lange, Klaus W., et al.). Today known as common symptoms of ADHD. When retracing the timeline, one can see that the medicine for ADHD was discovered before the disorder. It took around 25 years for Bradley's research to have influence but Benzedrine was the first stimulant drug used for hyperactive children, and pushed the disorder to what it is today.

I. Attention Deficit Hyperactivity Disorder: Today

Although Benzedrine is no longer used, Charles Bradley started a long timeline of stimulant medications to aid attention deficit hyperactivity disorder. Stimulant drugs are in fact still the most frequently used treatment of ADHD. Today, Methylphenidate is the stimulant of choice and is traditionally compared/related to amphetamine, which is also used in many ADHD medications. The first common medication was first synthesized in 1944 by Leanardo Panizzon. This drug named Ritalin, which is made up of methylphenidate, was first marketed in 1954 by Ciba-Geigy Pharmaceutical Company. After 1955, the drugs to medicate ADHD continued to grow, as did the disorder. A timeline of medications for ADHD, beginning with Benzedrine, can be seen in table 1.

Table 1: Timeline of ADHD Medication

- 1937- Benzedrine (racemic amphetamine)
- 1943- Desoxyn (Methamphetamine hydrochloride)
- 1954- Ritalin (methylphetidate)
- 1955-1983- Biphetamine (mixed amphetamine/ dextroamphetamine resine)
- 1960- Adderall (mixed amphetamine/ dextroamphetamine salts)
- 1975-2003- Cylert (pemoline)
- 1976- Dextrostat (dextroamphetamine)
- Dexedrine (dextroamphetamine)
- 1982- Ritalin SR
- 1999- Metadate ER (methylphenidate)
- 2000- Concerta (methylphenidate)
- 2000- Methylin ER (methylphenidate)
- 2001- Methadate CD (methylphenidate)
- 2001- Focaline (dexmethylphenidate)
- 2001- Adderall XR (mixed amphetamine salts)
- 2002- Ritalin LA
- 2002- Methylin (methyphenidate)
- 2002- Strattera (atomoxetine)
- 2005- Focalin XR (dexmethylphenidate)
- 2006- Daytrana (methylphenidate)
- 2007- Vyvanse (lisdexamfetamine dimesylate)
- 2009- Intuniv (quanfacine hydrochloride)
- 2010- Kapvay (clonidine hydrochloride)

As the types of medications increased, so have the diagnoses. From 1991 to 2013, ADHD medication prescriptions have increased by 500% and 9 medications were created between the years of 1937 to 1982. Adderall (mixed salts amphetamine), Ritalin (Methylphenidate), and Dexedrine (dextroamphetamine), are deemed to be the forefront pharmacotherapy for ADHD. Although the creation of these stimulants has increased aid for kids with attention deficit, it has also increased abuse of stimulant drugs exponentially. Due to the possibility of abuse, psychological dependency, and physical dependency, the U.S. Drug Enforcement Administration (DEA) classifies these stimulants as Schedule II substances (Desantis, 3). As formerly mentioned, this abuse can be seen primarily on college campuses.

In recent years, researches have begun to delve deeper into the illegal use of stimulants on college campuses. Studies have been constructed in the past testing college students on

ADHD abuse. This research as a whole has found that stimulant users were more likely to report use of cocaine, alcohol, cigarettes, and other high risk behavior. A past study in 2011 at the University of Kentucky by Alan D. DeSantis showed that up to 34% of students have illegally tried ADHD medication while in college, but only 4% were prescribed. Unlike most illicit drugs, the reason students take ADHD medication was not for entertainment or partying, but to help their academic performance. DeSantis revealed in his study that students at the University of Kentucky illicitly used ADHD medication to help them to concentrate and focus on academic tasks. While stimulant use was found by DeSantis to be most likely abused to focus on academics, the study also revealed that students at Kansas will also use the stimulant illicitly for the euphoric feeling it provides. Students admitted to taking the drug to have fun while studying, to stay awake and have fun at night, and to using it for the high it gives you.

II. Hypotheses

Past studies on ADHD abuse as well as the researches own observations throughout college have led to the hypotheses made when studying the population of students at the University of Arkansas. The first hypothesis made was rather broad in being that at least 15% percent of people at the University at Arkansas have illegally taken or regularly used ADHD medication. The next hypothesis created was that students who are prescribed ADHD medication are more likely to be diagnosed with depression. This hypothesis was made due to the primary researcher's observation that students who have an ADHD prescription are more likely to have anti-depression prescription. It is also shown in historical data that ADHD medication is known to cause depression and can have a symptom of suicidal thoughts.

Another observation made that led to a hypothesis was that the people that have used ADHD medication illegally have a higher chance to use other illegal drugs than students who have never tried ADHD medication. These drugs include primarily recreational drugs such as cannabis, cocaine, ecstasy, lysergic acid diethylamide (LSD), and others. This observation was constructed when conversing with University of Arkansas' Taylor, who has requested to keep her last name anonymous, stated that "Adderall had been a bigger gateway drug for me than cannabis." Cannabis is known to be the gateway to try other drugs, but Taylor's comment brought the researcher to the hypothesis that taking a stimulant could be the gateway to other stimulant type drugs like cocaine and ecstasy.

The next hypothesis lies within the use of cigarettes. Past studies have shown that the use of stimulants increases the high-risk behavior of smoking cigarettes, which led to the proposition that this is also true for students at the University of Arkansas. The final hypothesis continues away from educational predictions and drugs, and focuses on the appetite suppression that stimulants such as ADHD medication can cause. Due to stimulant's appetite suppressant, and because historical information that the University of Kentucky provides, it was hypothesized that ADHD medication is also illegally used at the University of Arkansas to aid eating disorders.

III. Process of Collecting Data

Because the sample would be from University of Arkansas students, an IRB was submitted and approved in order to conduct qualitative and quantitative research on campus. A questionnaire was conducted on a google survey, and taken by various students around the

campus of the University. To collect the sample of 266, multiple Walton Business and Fulbright professors sent mass emails to their students with a link to the survey. The primary researcher also asked friends and students studying around campus to participate in the survey in order to increase the final sample size.

While taking the survey, each student was asked if they were prescribed ADHD medication, not prescribed and have never tried ADHD medication, or not prescribed but have taken it in the past. The survey then led the student to a different section based on their answers. Each section had a commonality in questions shown in Table 2. The questions went more in depth with students either prescribed or not prescribed but have illegally taken ADHD medication before. For example, if the student smokes cigarettes, they are also asked if they smoke cigarettes more or less often on ADHD drugs. If they have struggled with an eating disorder, they are asked if they have ever used the drug to suppress their appetite. The specific questions for each section are as follows:

Table 2: Questions Asked in All 3 Sections

- Do you smoke cigarettes?
- Have you ever been diagnosed with depression?
- Have you ever suffered from an eating disorder?
- Which drugs have you tried? (select all that apply)

Not Prescribed ADHD Medication but Have Used Before

- What age did you first try ADHD Medication? (Ex.17)
- How frequently do you take ADHD medication?
- Would you describe it as easy or difficult to acquire ADHD medication?
- Have you ever suffered from an eating disorder?
- If YES, have you ever used ADHD medication to aid this disorder?
- Do you smoke cigarettes?
- If YES, do you smoke cigarettes more or less whenever you take this medication?
- Have you ever been prescribed medication for depression?
- Which drugs have you tried? (select all that apply)
- Why do you take ADHD Medication? (select all that apply)

Prescribed ADHD Medication

- What is the age when you were first prescribed ADHD Medication?
- If you no longer take this medication, when did you stop?
- Which ADHD prescription you are prescribed?
- Do you regularly take this medication?
- What dosage are you prescribed? (Milligrams)
- Have you ever suffered from an eating disorder?
- If YES, have you ever used ADHD medication to aid this disorder?
- Do you smoke cigarettes?
- If YES, do you smoke cigarettes more or less whenever you take your medication?
- Have you ever been prescribed medication for depression?
- Which drugs have you tried? (select all that apply)

The 266 students also all completed a demographic section at the end of the survey, and the questions can be seen below:

Demographics

- Age
- Gender
- Ethnicity or Origin (Race)
- Sexual Orientation
- Hometown (City)
- Hometown (State)
- Classification
- College
- Are you in the honors college?
- What is your cumulative GPA?
- Member of a Greek Organization

From the final sample of 266 students, 170 were females and 96 were male. An option for gender of "prefer not to say" was offered, but not chosen by anyone surveyed. The vast majority of the sample of 266 were Caucasian (225 out of 266). The minority races can be seen in Figure 1.

Due to the primary researcher being in the Walton College of Business, 235 of the students sampled were a part of the Walton Business college as well. The distribution of colleges can be seen in Figure 2 with 29 being in Fulbright, 5 being in Bumpers, 3 in Engineering, and 6 in Education. The mean age of the 266 students is 20.4 and the classification proportion of the students can be seen in Figure 3. The sample also included one graduate student who is not shown in the classification pie chart. One hundred and seventy-five of the sample students are not in the honors program and the remaining 91 are in the honors program of their college. Finally, 141 students are part of Greek life and 125 are not.

The sampling process lasted about 4 months and multiple reforms of the survey took place throughout the months. The initial survey sent out collected about 170 student's responses. Later that sample had to be cut out due to a redesign

Figure 1: Minority Races

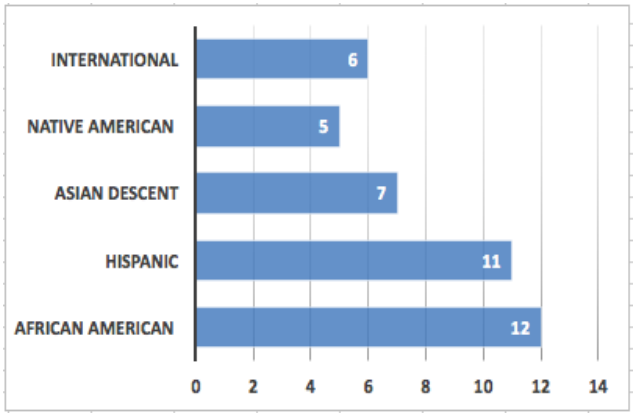


Figure 2: Colleges

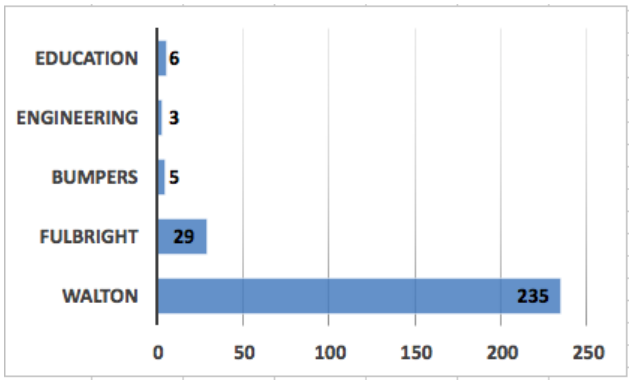
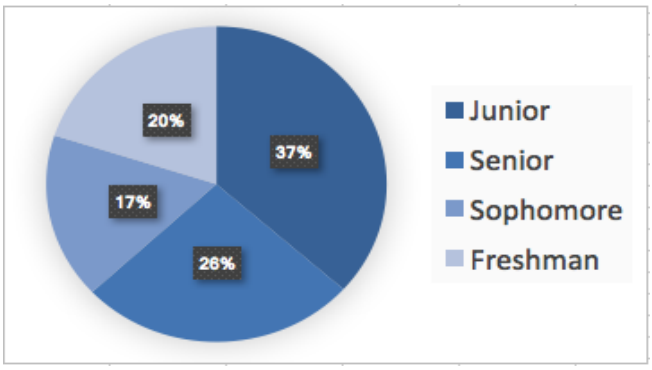


Figure 3: Classification



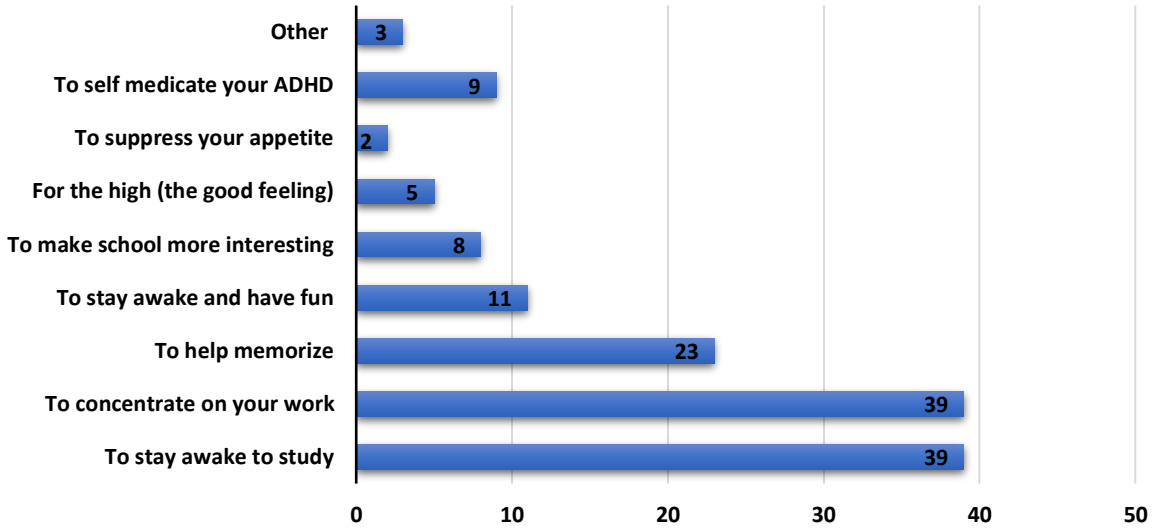
of the survey in order to make the results easier to analyze and compare.

IV. Analyzed Data

Reasons for abuse

At a final sample size of 266, it was found that roughly 18% of students at the University of Arkansas have illegally taken ADHD medication, 18% are prescribed ADHD medication, and the remaining 64% have never tried it. From the 18%, the mode age of when they first illicitly tried it was 18. This data shows that students at University of Arkansas likely try ADHD medication their freshman year of college. The 18% of students who are not prescribed ADHD medication is substantially lower than the historical data found at University of Kentucky, but still shows a worrisome number of students that have abused a stimulant drug, as are the reasons they take them shown in Figure 4.

Figure 4: Reasons For Illicitly Taking ADHD Medication



Staying awake to study and concentrating on school work are the top two reasons students abuse ADHD medication at the University of Arkansas. The third highest reason being to help memorize, and the following four being for recreational uses or to self medicate. Only 2 people sampled have used ADHD medication to suppress their appetite, and 3 have taken it for a reason not available in the survey.

In order to test the hypothesis predicting that at least 15% percent of students at the University of Arkansas have illegally taken, a one sample z-test for proportions test was performed. This sample included the 49 people who have illicitly tried ADHD medication out of the 266 students sampled. Although the sample proportion was 18.4%, the test shows insignificant results. With a p-value of .0594 and a level of significance of 5%, the null could not be rejected and the test concluded that no more than 15% of the students at the University of Arkansas have illicitly tried ADHD medication. Results can be seen in Table 3.

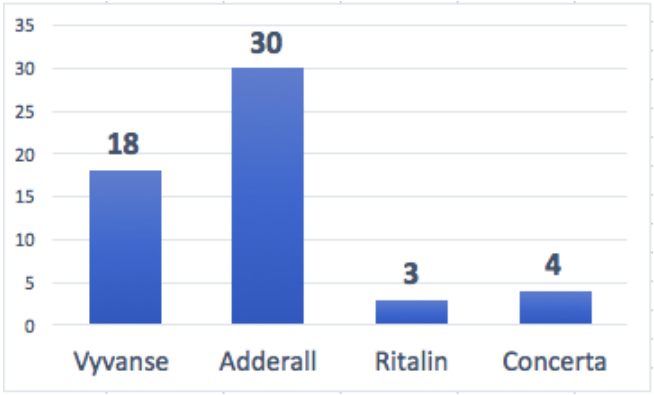
Table 3: Z-Test One Sample

Z-Test: One Sample Proportion	
Critical Value	1.645
Z-stat	1.56
P-value	0.0594

Types Of ADHD Medication

The main presciption that students at the University of Arkansas are prescribed is the ADHD prescription named Adderall. Sixty-one percent of the students sampled who are prescribed ADHD medication have been prescribed Adderall at least once in their life. The second most prescribed ADHD medication for students at the University of Arkansas is Vyvanse. Roughly 33% of the students sampled are prescribed Vyvanse. The remaining medications mentioned were Ritalin and Concerta. The prescriptions that the 49 people who were sampled take currently can be seen in Figure 5.

Figure 5: Students Current Prescription



Grade Point Average (GPA)

Table 4: GPA Proportions

Statistic	*Never Tried*	*Illicitly Tried*
Number of Successes	110	19
Sample Size	169	48
Sample Proportion	0.6508876	0.3958333
Difference of Proportions	0.255054241	
Pooled Proportion	0.5944700	

Unlike other illicit drugs, the main reason for illegally taking ADHD medication is not for entertainment or recreational purposes, but as a tool to help students with school. Anticipating this, we asked students about their cummulative GPA. We then conducted post-survey statistic tests comparing students who illicitly abuse ADHD medication versus students who have never tried it. Students who have never tried it are more likely to get above a 3.5 GPA at school. This proportion can be seen in Table 4. The alpha used in this test (as well as all other tests for consistency) was 5%. The p-value of a one tailed test is .0007 and the p-value of a two-tailed test was .0015, as seen in Table 5. The null hypothesis was therefore rejected for the GPA of students who have never taken ADHD medication is higher as well as different than students who have illegally tried it. This is a surprising result when considering that students are taking this drug in hopes to increase their academic performance.

Table 5: GPA Results

Calculated	*Z-Test*
St Dev of Difference	0.08030496
z Test Statistic	3.1761
p value (one-tailed)	0.0007
p value (two-tailed)	0.0015

Use of Illicit Drugs

Another highly significant result in a pre-test hypothesis is the one involving higher drug usage in students who are either prescribed or have tried ADHD medication versus the students who have never tried. Because the data collected on drugs was also qualitative, a 2-sample proportion test was preformed for use of illicit drugs. Tests on individual drugs chosen in the survey were not ran, but instead anyone who tried a drug was added to the proportion. These drugs include cannabis, ecstasy, cocaine, LSD, ketamine, and heroin. The initial test ran was

students who have never tried ADHD medication against students who are not prescribed it but have tried it. The results of this test were highly significant showing that students that have illicitly tried ADHD medication are much more likely to try other recreational illicit drugs than those students who have never tried ADHD medication. As seen in Table 6, the p-value for both a two-tailed test and a one-tailed test are both 0.000. The results showed that 89.5% of students who have illegally tried ADHD medication have also tried a recreational drug. Only 32% of students who have never tried ADHD medication have tried an illicit drug.

Table 6: Drug Usage Results (Never Tried vs Illicitly Tried)

Calculated	Z-Test
St Dev of Difference	0.08131724
z Test Statistic	-7.0871
p value (one-tailed)	0.0000
p value (two-tailed)	0.0000

Table 7: Drug Usage Proportions (Never Tried vs Illicitly Tried)

Statistic	Never Tried	Illicitly Tried
Number of Successes	54	43
Sample Size	169	48
Sample Proportion	0.3195266	0.8958333
Difference of Proportions	-0.576306706	
Pooled Proportion	0.4470046	

The next test ran involving drugs was a 2-sample for proportions test with students who have never tried ADHD versus students who are prescribed ADHD medication. This will help test the hypothesis made when student Taylor who is prescribed the ADHD medication Adderall, said she found herself more open to other drugs because she is prescribed ADHD medication. The proportion found for this test can be seen in Table 8 and the final results can be seen in Table 9. As one can see, these results also came out significant and proves that at a 5% significance level, students who are prescribed are more likely to try an illicit drug than students who have never tried it. Like the previous test, the results show an extremely high significance with a one-tailed and two-tailed p-value of 0.000.

Table 8: Drug Usage Proportions (Never Tried vs Prescribed)

Statistic	Never Tried	Prescribed
Number of Successes	54	38
Sample Size	169	49
Sample Proportion	0.3195266	0.7755102
Difference of Proportions	-0.455983577	
Pooled Proportion	0.4220183	

Table 9: Drug Usage Results (Never Tried vs Prescribed)

Calculated	Z-Test
St Dev of Difference	0.08013266
z Test Statistic	-5.6904
p value (one-tailed)	0.0000
p value (two-tailed)	0.0000

These results concerned with the illicit use of drugs therefore show that the null hypothesis is rejected for both groups (prescribed vs. never tried and never tried vs. illicitly tried.) This does not necessarily mean that because one is prescribed or has taken ADHD medication that they are more likely to try other drugs after. But taking ADHD medication does have a clear correlation with students use of illicit drugs.

Smoking Cigarettes

The next qualitative data tested was for the hypothesis that people who use ADHD medication smoke more tobacco than those who have never tried. Another 2-sample for proportions test was ran. Although, in this test the 49 students who have illicitly tried ADHD medication and the 48 students who are prescribed were added together to make one sample of 97. Therefore the 97 students who have either tried or are prescribed to ADHD is compared to

the 169 who have never tried the drug. The proportion can be seen in Table 10 and the results to the right in Table 11. With another low p-value, the null hypothesis is rejected and shows that students who have taken or currently take ADHD medication are more likely to smoke cigarettes.

Table 10: Smoking Proportions (Never Tried vs Prescribed & Illicitly tried)

Statistic	Never Tried	Prescribed & Illicitly Tried
Number of Successes	11	33
Sample Size	169	97
Sample Proportion	0.0650888	0.3402062
Difference of Proportions	-0.275117428	
Pooled Proportion	0.1654135	

Individual tests were also ran using just illicitly tried versus never tried and prescribed versus never tried which. Both tests were also shown significant. Only 11 students out of 169 students who have never tried ADHD medication smoke cigarettes (6% of students), while 20 students of out the 48 that have illegally tried ADHD medication (42% of students) smoke cigarettes. The p-value of this 2-sample for proportions test was 0.000 for both a one-tailed and two-tailed test, therefore rejecting the null. When looking at students who are prescribed ADHD medication, 13 out of the 49 smoke cigarettes (27% of students). When comparing this proportion to the 6% of students who have never tried ADHD medication but smoke cigarettes, the p-value is 0.000 for a one-tailed test and is 0.0001 for a two-test. This test also rejects the null and proves that students who are prescribed ADHD medication are also more likely to smoke cigarettes than those who have never taken it.

Table 11: Drug Usage Results (Never Tried vs Prescribed & Illicitly)

Calculated	Z-Test
St Dev of Difference	0.04732959
z Test Statistic	-5.8128
p value (one-tailed)	0.0000
p value (two-tailed)	0.0000

Another question asked both students whom take ADHD drugs illicitly and are prescribed was if taking the medicine increased, decreased, or had not effect on their smoking of cigarettes. Eleven of the 20 students who smoke cigarettes that take ADHD medication illicitly smoke more often when they take the medication. Seven of the 13 students who are prescribed ADHD medication and smoke cigarettes smoke more when they take their ADHD prescription. When combining illicit users of ADHD medication and students prescribed, roughly 55% of these students smoke cigarettes more often when they take the ADHD drug.

Depression

The next test ran was to test the hypothesis that students prescribed ADHD medication are more likely to be diagnosed with depression than students who have never tried ADHD medications. The sample proportion of students at the University of Arkansas who have never tried ADHD medication but have been diagnosed with depression is 13%. The sample proportion of

Table 12: Depression Proportions

Statistic	Never Tried	Prescribed
Number of Successes	22	19
Sample Size	169	49
Sample Proportion	0.1301775	0.3877551
Difference of Proportions	-0.257577587	
Pooled Proportion	0.1880734	

Table 13: Depression Results

Calculated	Z-Test
St Dev of Difference	0.06340287
z Test Statistic	-4.0626
p value (one-tailed)	0.0000
p value (two-tailed)	0.0000

students who are prescribed ADHD medication and have been diagnosed with depression is roughly 39% of students. These outputs can be seen in Table 12. When running a 2-sample proportion z-test, the results were significant. With a p-value of 0.000 for both a one-tailed and two-tailed test and a level of significance of 5%, the null hypothesis was rejected, suggesting that students that are prescribed ADHD at the university of Arkansas are more likely to be diagnosed with depression than students who have never tried ADHD. This relationship could be for multiple reasons which will be further discussed in the following section.

V. Discussion

Although the hypothesis that more than 15% of students at the University of Arkansas was rejected from the sample proportion of 18%, the analyzed data still shows interesting conclusions. For example, significant relationships were found with tests on grade point average, use of illicit drugs, smoking cigarettes, and depression. The reasons that taking ADHD medication correlates with these factors allows further hypotheses to be made and further research to be done.

For example, there are multiple reasons one could be more likely to be diagnosed with depression when they take some type of ADHD medication versus students who have never taken it. If someone has the money to be able to go to a psychiatrist and be diagnosed with ADHD and depression, where someone else could go undiagnosed due to funds. It could therefore be just a matter of money and/or the will to go to a psychiatrist. A more scientific reasoning can be deferred from the symptoms caused by taking a drug like Adderall. When someone without or only a mild case of ADHD takes Adderall, a euphoric feeling can be caused. This euphoric feeling can include increased confidence, concentration and energy. With this also comes negative side effects such as anxiety, increased blood pressure, nausea, and depression. The depression side effect most commonly comes with the come down from the euphoric high of Adderall (and other ADHD medications). When one commonly takes Adderall, the come down can be similar to the come down of cocaine. Therefore, one often experiences sleep problems, sluggishness, and depression. This side effect of Adderall could also be a reason that someone prescribed ends up being diagnosed with depression ("Adderall Depression | Does Adderall Cause Depression?").

Smoking cigarettes is a more difficult correlation to hypothesize. It is known (and proven in this research) that stimulant users smoke cigarettes at higher rates. Although little is known about this relationship. Results of a research suggest that early exposure to nicotine may influence an addiction to stimulants, but there is no data explaining why one who was prescribed ADHD medication at an early age is more likely to smoke cigarettes.

When it comes to the illicit use of drugs and the relationship to users of ADHD medications, it is a bit clearer. ADHD medication is usually taken for studying purposes but it can also give a user the euphoric effects of recreational drugs. This could allow Adderall to be a gateway to other drugs or other drugs could be a gateway to Adderall. As student Taylor said, she found that her prescription to Adderall led her to try other drugs, which is likely due to the young age that most students are prescribed ADHD medication. This also could mean that the students who are not prescribed ADHD, but have tried it to study, have made them more comfortable with trying other drugs as well. It seems as if the usage of ADHD drugs and illicit drugs can be somewhat of a continuous cycle.

The hypothesis that predicted using ADHD mediation to aid an eating disorder was not highly significant. Only 4% of the students who are either prescribed or have tried ADHD medications have used them to aid an eating disorder. Although this is a relatively low number, it is still existent and should have prevention. Most of the students sampled that abuse ADHD medication for weight purposes were not prescribed it, and therefore do not know the repercussions of using ADHD medication as a weight loss supplement. Prevention of using drugs to study is already done during finals week at the University of Arkansas, but the university and sororities should also consider the prevention of using ADHD medication to help with ones eating disorder.

Lastly, the evidence that grade point averages are significantly higher for students that have never taken ADHD medication is not expected. The majority of students who illicitly take ADHD medication use it for study purposes, and to hopefully raise their GPA. If students knew that you are likely to have a higher GPA if you do not take study drugs when they need to study, the abuse of these medications would likely go down.

Conclusions Summarized:

- Less than 15% of students at the University of Arkansas have illicitly taken an ADHD medication.
- Adderall and Vyvanse are the highest prescribed ADHD medication at the University of Arkansas.
- the GPA of students who have never taken ADHD medication is higher than students who have illegally tried it.
- Both students who are prescribed and have illicitly used ADHD medication are more likely to have tried illicit drugs than students who have never tried ADHD medication.
- Both students who are prescribed and have illicitly used ADHD medication are more likely to smoke cigarettes than students who have never tried ADHD medication.
- Students who are prescribed ADHD medication are more likely to be diagnosed with depression than students who have never tried ADHD medication.

Future Research

Due to time, finances, and current knowledge, the research did not go as far or as in detail as it could in the future. Future research could be done in the correlation between stimulants and tobacco use. There is not much known information on it currently, but there is in fact a known relationship between stimulants and tobacco.

One could also further this research through personal interviews with those who do abuse ADHD medications and those who are prescribed ADHD medication. This would give a more intimate outtake and help the researcher and readers understand why and how students abuse ADHD medications. Interviewing students who are prescribed and have distributed out their medication would also be interesting and valuable research.

Due to the primary researcher being in the business school, the majority of the students sampled were in the Walton College of Business. If one was to develop further research on the abuse of ADHD medication at the University of Arkansas, a bigger and more diverse sample would help the distribution to become more normalized.

After the research constructed for this senior thesis, one can see that the stimulant drug prescribed for ADHD has become quite a phenomenon. The abuse of it at the University of Arkansas is a highly abused prescription drug on campus, for over 15% of students sampled have taken it illicitly before. Although some small prevention and awareness happens today at the University of Arkansas, it would not hurt to have more information provided to incoming razorbacks about this phenomenon and that, according to research, it does not necessarily aid one's GPA. If anything, studies in this research show the opposite. If the University could target the students that tried ADHD medication their freshman year (the majority of students) they would be able to decrease the number of students who abuse study drugs at the University of Arkansas.

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